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The MONTHLY REVIEW

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A SOCIETY FOR THE ADVANCEMENT OF THE SCIENCE OF ELECTRO-PLATING

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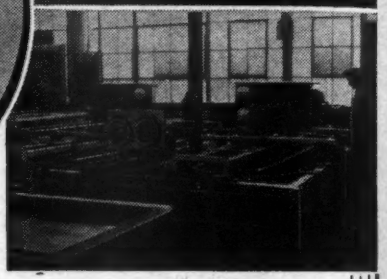

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The MONTHLY REVIEW

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The Supreme Society's Contribution to the Membership Drive

The response which has been received regarding our membership drive has been very gratifying, and the final success for it in each of our twenty-five branches is directly in the hands of the membership committee of each branch, who are the three elected members of the Supreme Society for 1934 - 1935.

If they will "take off their coats," and give the needed impetus to this drive, our 1st Vice-president, Mr. Underwood, as chairman of their committee, will be able to render a successful report at Cleveland, June 8, 1936.

The plan calls for the month of December being designated American Electro-Platers' Society Membership month, and the prospect-for-membership list should be started at once by all of our local branches.

The branch membership is divided into three groups, with one of the membership committee responsible for a group, and these groups could be designated as the "Red", "White", and "Blue," campaigners, respectively. This method can create considerable friendly rivalry and stimulus in bringing in new members, by the different groups. If the local branch's treasury will permit, the group winning the membership contest could be feasted in this comparison: "Filet au Mignon for the winners, beans for the losers." The following schedule could be used for counting the points:

1. Individual attendance at meetings	1 point
2. Attendance of a prospective member	1 point
3. New Members	10 points
4. Each prospective member registered	½ point
5. Each MONTHLY REVIEW mailed to prospective	½ point
6. Attendance at meeting of 75% of group	10 points

It is hoped that the branches will avail themselves of extra copies of our MONTHLY REVIEW to use in contacting prospects. This method of approach will be advantageous in showing a prospect what the American Electro-Platers' Society is doing in making education easy of access to our members. We, as members of the A.E.S. are proud of the position we occupy in the plating industry, we are also proud of the respect and friendship extended to our Society by other organizations in the plating and chemical industry. If we as a society command this honor and respect, our official publication has done much to warrant it, and merits the expenditure of time, effort and expense to place it in the hands of a prospect-for-member. A suitable letter should accompany the REVIEW and as a suggestion offer:-

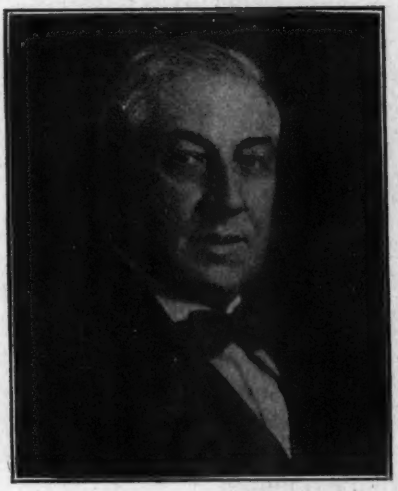
Mr.-----. This complimentary copy of the American Electro-Platers' Society's MONTHLY REVIEW is sent to you upon the request of Mr.-----. Its pages contain many valuable articles pertaining to electroplating and its allied arts, as well as interesting reports of the activities of our branches in all parts of the United States and Canada.

----------Branch of the A. E. S.

The prospects should then be contacted personally or by other methods,and this constant pounding, gentle as it will be, is bound to make an impression upon some of them. The same procedure should be pursued with delinquents or suspended members, as there is always the possibility of getting them back on the books. Many delinquencies and suspensions are due to financial stringency and keeping in touch with a former member makes it easier to bring him back when his financial situation improves.

We hope that this membership drive will bring us new blood of the type and character that we need, as we must be seeking only members who will be a credit to our organization. Men who are keen, studious and willing to share their knowledge and efforts in return for the honor and what we can teach them by their membership in the A.E.S.

THOS. F. SLATTERY, *President.*



Death of Mr. Palmer H. Langdon

Every member of the American Electro-Plater's Society will regret the death of Mr. Palmer H. Langdon who passed away on the 27th of September, 1935. Mr. Langdon as Editor of the *Metal Industry* was deeply interested in the A.E.S. and for years gave our organization strong support in every branch of its work.

During the recent convention in Bridgeport Mr. Langdon's voluntary contribution was in a great measure responsible for the success of that event. The Plater's Society at this Convention honored Mr. Langdon by electing him an honorary member.

Our entire membership joins in extending to the immediate family of the deceased our heartfelt sympathy in their bereavement and to the official family connected with the *Metal Industry* we can truly say "to live in the hearts of those we leave behind is not to die."

Hanson-Van

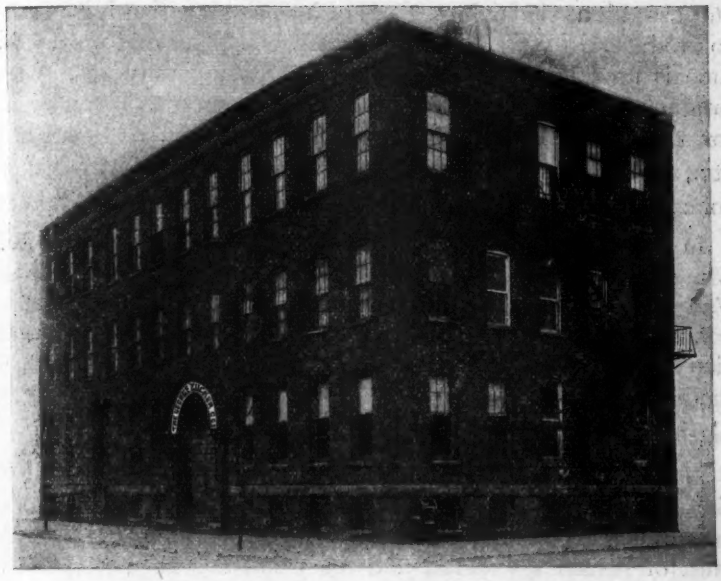
Winkle-Munning

to Honor

Henry L. Zucker

It is seldom that any man has the distinction of serving one industry continuously for 50 years. Such a distinction is one in which the Hanson-Van Winkle-Munning Company takes great pleasure in honoring its Vice President, Mr. Henry L. Zucker, who for the past 50 years, beginning with the 22nd day of October, 1885, has been continuously employed in the manufacture, designing and processing of plating and polishing compounds for the metal plating and all other industries employing abrasives for polishing and cleaning purposes. Mr. Zucker furthermore has the unique distinction of carrying on the original work founded by his Father in the year 1860, for it was in that year that his Father, Mr. George Zucker, began the manufacture of polishing rouge in America in a steam kettle in his own home.

Seventy-five years ago rouges were commercially unknown in America and when Mr. George Zucker began to manufacture them in his own home they were made in small quantities and distributed among jewlery supply houses and technical industries, such as gold, silver and allied trades, microscopic and lens in-



dustries, etc. From this small beginning the firm of George Zucker Company was organized in 1862. It was the first commercial firm devoted exclusively to the manufacture of rouges and compositions in America. Successful from its inception it was awarded the gold medal for rouges and compositions at the United States Centennial Exposition of 1876 in Philadelphia.

Not content with rouges and compositions, Mr. George Zucker, with the cooperation of his sons, branched out in the manufacture of tripoli and lime compositions, and from their experiments the world famous "Acme Lime" was brought into being. This lime was the first successful commercial attempt to manufacture a substitute for the crocus and rouges used for the polishing and plating of nickel, and stands today as the peer of all lime compositions. It commands as high respect after a period of 40 years as when first put upon the market, and is sold today exactly as made from the original formula in 1892. This lime made possible the sale of high lustre, nickel plated bicycles, which were so much in vogue in that period, and really revolutionized the buffing of nickel beginning with that period. No substitute has been invented or put on the market which has in any way equalled or

surpassed it as the highest grade of lime composition it is possible to produce. In fact, the word "Acme" is a household word where lime is used in large quantities for polishing purposes. Other products were added from time to time, such as compositions for the rubber industry, celluloid industry, bakelite industry, etc., all of which helped to enhance the reputation of Mr. Zucker's concern.

In 1916 the George Zucker Company was merged with A. P. Munning & Company, which in turn became the present Hanson-Van Winkle-Munning Company in 1927. During all of these years Mr. Henry L. Zucker has given constant and careful attention to all of the progress and developments which have been made in the polishing and finishing abrasive field of the electroplating and allied industries.

Mr. Zucker's genial disposition, his wide knowledge and experience in this particular field, and his many improvements and inventions in buffs and compositions, places him in the foremost rank of polishing experts, and his Company is very proud to acknowledge the value of the services which he has rendered not only to them but to the entire industry. In fact, during Mr. Tucker's reign as Vice President of the Metal Finishers' Equipment Association, he was constantly consulted and gave freely of his knowledge to any competitors who wished to have information concerning the history or the trend of development in his particular field.

Mr. Zucker has been continuously since 1916 the Vice President in charge of production of polishing and plating compositions for A. P. Munning & Company and the Hanson-Van Winkle-Munning Company, and it is hoped that he will continue to be for many years to come to the advantage of themselves, the customers and the trade in general. He has with him one son, to whom he has been teaching this business so that his good work can carry on.

Everyone of Mr. Zucker's friends and associates is a little better for his having lived with and among them and the Hanson-Van Winkle-Munning Company in arranging to mark the 50th Anniversary of his entry into this business, wishes him good luck and a continuation of the happiness he has had from seeing his developments used throughout the world.

Shorter Days Are Here

IN general, the period of heaviest city-street traffic is from 5-9 P. M. Congested traffic increases the number of opportunities for motor-vehicle accidents, and the records show that more accidents actually occur between 5 and 9 P. M. than during any other four hours of the day.

Another significant fact is that more accidents occur during this period in the autumn and winter months than in the spring and summer months (this also is shown by the records), notwithstanding the fact that winter traffic is somewhat lighter than summer traffic.

Of course, there are many stormy days during the autumn and winter months when rain, snow, or ice, makes the pavements slippery, clouds the wind-shields of cars so that visibility is reduced, and increases the possibility of accidents in other ways. The danger to pedestrians is greater also under these conditions. They are more likely to slip on the pavements and fall in front of moving cars; and during rain and snowstorms they often proceed more or less blindly because the open umbrellas which they carry to *protect their clothes* prevent them from seeing approaching cars that may *endanger their lives.*

However, referring again to the records, we find that storms and slippery road surfaces are less-important factors in accident occurrence than might be supposed, because 84 per cent. of all motor-vehicle accidents in 1934 occurred in clear weather, and 74 per cent. of all accidents took place when the road surfaces were dry. This seems to indicate that the more serious hazards arising from certain dangerous conditions that are apparent, are offset to a large extent by the exercise of greater care by the users of the streets and highways.

Darkness is another condition that must be considered as having an influence on accident occurrence, and it is probably of greater importance than either heavy traffic or the weather. Dusk or darkness prevails throughout the greater part of the period 5-9 P. M. during the autumn and winter months. Automobile headlights cannot provide illumination comparable with daylight. The street lighting in the main business sections of many cities

is adequate for safety, but as a rule the illumination on the heavily traveled thoroughfares outside of the business areas, has not been improved to correspond with the changes in the amount and nature of traffic brought about by the substitution of automobiles for horse-drawn vehicles.

During the normal daylight hours, 6 A. M. - 6 P. M., in 1934, 459,510 automobile accidents resulted in 15,050 deaths, in the United States. During the normal hours of darkness, 6 P. M.-6 A. M., when the volume of traffic, generally, is only one-fifth as great as in daytime, there were 422,940 accidents in which 20,950 persons were killed.

The number of accidents was smaller during the dark hours but the number of *deaths* was greater. Furthermore, "the rate of death per accident was 51.4 per cent. worse during the hours of darkness than during the hours of daylight, and on the basis of traffic volume, it was several hundred per cent. greater."*

"Last year, 2,810 persons were killed in 79,380 accidents in the four rush hours from 6 to 10 in the morning, while 10,940 were killed in 252,250 accidents in the four rush hours from 5 to 9 in the evening. The deaths in the four evening hours exceeded the record of the four morning hours by 289 per cent."

Heavy traffic and inadequate illumination, to which are added, on many occasions, stormy weather and slippery road surfaces, are unfavorable physical conditions which are largely unavoidable and unpreventable. They increase the opportunities for accidents but are not actual causes of accidents. The chief reason for the larger number of accidents during the hours 5-9 P. M. in the autumn and winter months, is that motorists and pedestrians do not recognize the increased hazards; or, if they do recognize them they fail to exercise the greater amount of care required for safety under the adverse conditions which tend to make the shortest days of the year the most dangerous, for users of the streets.

"Shouldn't drivers be afraid of the dark, and shouldn't pedestrians take more than the usual precautions when crossing streets or walking along highways during hours of dusk and darkness?"

—*The Traveler's Standard*

Quotations from "*Thou Shalt Not Kill*", published by THE TRAVELERS.

Brightening Up the Plating Room

R. A. COOLAHAN

Read at the Bridgeport 1935 Convention

TWO of the papers which have some relation to my paper are the ones on air conditioning and on corrosion, and in this connection I would like to point out that whether or not you air condition your plating room, it is important to safeguard your investment in tanks, structural steel and generators from corrosion to the best of your ability.

Because of the highly acid and alkaline conditions existing in plating rooms and the high humidity experienced, particularly in the winter months, it has been practically impossible to dress up or brighten up the plating room. Very similar conditions are experienced in paper mills and dye-houses. In most plants of this nature, the short life of the paint film has made it uneconomical to brighten up.

The primary function of paint is protection. Protection means less repair work and fewer replacements, and, therefore, smaller overhead. Where paint fails to protect, its use is abandoned in industrial plants. Industries like to brighten up their shops because they know from experience that under such conditions more efficient work results, but they cannot afford to brighten up merely for the sake of dressing up, unless some protection is afforded also.

As a matter of fact, plants will go to the other extreme and drape their plants in black, where protection can be obtained only by use of bitumastic products. The ideal paint is one which affords not only protection, but also brightens up the shop. Paints of this nature are now becoming available through an increasing list of paint and varnish manufacturers who are utilizing a chlorinated rubber product developed in Germany, the manufacture of which has only recently started in this country. This new product is called Tornesit.

A few years ago, our European representatives brought this development to our attention. In our earliest investigational work, the properties that immediately appealed to us were its

great resistance to acids, alkalies and salts; its dielectric strength; and its strong adhesion to metal and even to concrete.

Because we do not manufacture paints, we passed these observations on to paint manufacturers, who realized the importance of a raw material containing the unusual combination of properties possessed by Tornesit. Today, paints formulated from this new base are giving very much longer service in many industries and are making it possible not only to protect but to brighten up many places that previously were not painted.

Tornesit is a white and very fluffy powder. It is a resin-like raw material that is highly chlorinated, stable, chemically inert, non-flammable, non-combustible, and practically odorless. It has a specific gravity of 1.5.

Tornesit is not merely a new ingredient for paint or lacquer. It is the base of an entirely different protective coating. In our opinion, it is one of the most important developments in the protective-coating industry since the discovery of Nitrocellulose as a base for lacquers.

No other film approaches Tornesit in resistance to acids, alkalies, and the many other corrosive elements that are destructive to paints. For the first time, it gives the paint manufacturer a material that can be formulated into *both* an acid, *and* alkali-resisting paint. Other paint bases may resist acids, yet be disintegrated by alkalies. Films of many alkali-resisting paints are quickly disintegrated by acids. Paints formulated with Tornesit, however, resist both alkalies and acids, and no other paints surpass Tornesit films in resistance to either one.

One of the most outstanding characteristics of Tornesit paints is their great resistance to corrosive influences. Not only is usual protection afforded steel against rusting, but because of the chemical inertness of chlorinated rubber, Tornesit paints, when properly compounded, exhibit striking resistance to potassium and sodium cyanide, ammonium nitrate solution, sodium hydroxide, sulphuric, chromic, phosphoric, hydrochloric, nitric and lactic acids, bleach solutions and corrosive gases, such as chlorine, sulfur dioxide and ammonia. After more than three years of exposure on the test fence in Wilmington, Delaware, steel panels coated with Tornesit paints are still well protected; the metal under the paint is still bright and free from rust.

Tornesit produces a hard, tough film, being approximately the

same in these properties as Nitrocellulose lacquer films. Other important properties of properly formulated Tornesit paints are flexibility and tenacious adhesion.

Tornesit paints have excellent adhesion to concrete and, because of the toughness of the films, they are especially resistant to abrasive influences.

Clear Tornesit has good dielectric properties; in fact, no protective coating exceeds it in this regard. Its dielectric strength is retained in the presence of moisture.

This recent chemical development makes it possible not only to protect, but to improve the appearance of your plant. It is being used successfully in paper mills and dye-houses, as well as in plating rooms and numerous other chemical plants.

Tornesit should be of special interest to silver platers, in whose plants cleanliness is essential to successful work. In work of this type, dirt, dust and metal particles must be eliminated so far as is possible. Moreover, the plater requires good light for proper inspection of his finished jobs.

To obtain these conditions, the paint used must be chemically resistant and must have no pores or crevices for dirt to accumulate. Paints with mild chemical resistance are not good enough because they break down too readily, and this is expensive when it is realized that labor and inconvenience in applying the paint are of major importance.

It is, therefore, very important to the plating industry in general and to silver platers in particular to use a paint of maximum chemical resistance to obtain long and satisfactory service. In this connection, it should be pointed out that film thickness is something that often fails of emphasis. A one-coat job is no paint job at all. Two coats should be the minimum, and three coats will reward the plant exercising this degree of care.

Main paints soften under the humid conditions of a plating room with the immediate loss of gloss. This condition permits fast accumulation of dirt. Paints containing Tornesit dry as rapidly as lacquers and remain hard even under most humid conditions.

Tornesit paints may be applied by spraying, dipping, flowing or brushing. A good film can be obtained by any of these methods.

As stated before, I believe that this new development is of interest to the American Electro-Platers' Society, and I appreciate the opportunity of bringing this brief message to you.

Electroplating **Zinc Base** *Die Castings*

CHARLES H. COSTELLO

Read at Bridgeport 1935 Convention

THE first operation to be performed in the finishing of zinc base die castings is the removal of fins, run marks or other imperfections on the surface of the casting. This may be done as follows:

1. Grind if necessary with 120 emery and oil on a felt or canvas wheel.
2. Polish on a greased felt or rag wheel, using 180 emery.
3. If the casting is to receive a heavy copper plate, followed by a heavy nickel plate, the surface may be finished with 200 emery, or with a greaseless buffing composition. If, however, the casting is to be only nickel plated, the surface must be buffed free from pits and imperfections until it is brought to a point where it is equal to the surface required on the finished article. This is necessary, as a nickel plate will not cover defects in the casting, without becoming so heavy that the danger of cracking is great.

The main point to be observed in preparing the surface of any die casting is to remove as little metal from the surface as possible. Zinc die castings are all more or less porous throughout, but the densest metal, or at least the metal with the least porosity, is found at the surface of the casting, and it is desirable to preserve as much of this fairly dense portion as possible.

With the polishing and buffing operations completed, the casting, as free from pits as possible, is ready to clean and plate.

The proper cleaning of die castings is somewhat of a problem. Unless the article is quite plain and free from pockets or deep impressions, it is advisable to remove most of the buffing dirt before using the alkaline cleaner. The castings may be wiped with a soft cloth by the helper doing the racking, or they may be washed in some organic solvent such as carbon tetrachloride, benzene or naphtha, or a non-inflammable mixture of solvents with CCl_4, or they may be cleaned in a solvent degreaser. After the solvent becomes greasy it is necessary to use a final solvent rinse. As the vapor in the degreaser is being continually distilled, any additional rinsing is unnecessary. The solvent degreaser is

probably the best method, as it produces a surface that is very clean and only needs a slight alkaline cleaning to wet the surface before plating. If rubber covered racks are used for plating, it is of course necessary to clean in the solvent or degreaser before the work is put on the plating racks. In some cases it is most economical to degrease or wash the work after the cutting down operation, and color the work just before it is plated. In other cases the work may be cleaned in baskets or racks and transferred to the plating racks by the plater after buffing is completed.

After the casting has been washed in solvent or degreased, it is given a final cleaning in a mild alkaline cleaner. A satisfactory cleaner can be made up of 2-6 ounces per gallon of trisodium phosphate, or sodium meta silicate. The cleaner should be operated at 200 degrees Fahrenheit to boiling. The cleaning is done electrolytically with the work, as cathode at six volts with enough current to cause vigorous gassing. It is advisable to use removable steel anodes, as these are more easily cleaned than the sides of the tank, if the tank is used as anode.

The scale which forms on the tank and anodes cuts down the current considerably after being in operation a short time, and it is a good plan to clean off the scale frequently. The time of cleaning should be determined for each different article to be plated, and should be as short as is practicable for complete cleaning. The time will vary for different pieces, but twenty seconds to one minute is generally sufficient. The longer the work has to remain in the cleaner, the milder the cleaner must be to avoid discoloration of the zinc. Discoloration of the zinc can generally be overcome by using a weaker alkaline cleaner, reducing the temperature of the cleaner, or reducing the time of cleaning.

There are innumerable commercial cleaners that are perfectly satisfactory for the cleaning of zinc base die castings, and if one of these is used it is essential that the manufacturer's directions in regard to concentration and operating temperature be followed to get best results. A commercial cleaner should be chosen that is free from compounds, soaps or inhibitors that might make rinsing difficult, or insoluble material in suspension that may be occluded on the cathode during electrolysis.

Rinsing is a most important step in the finishing of die castings. Because of the porosity of the metal it is difficult to rinse out all

the cleaner or solid particles that may lodge in the pores. In some cases a hot rinse, followed by a cold rinse, is sufficient. In other cases, where the porosity is bad, a real soak in cold running water is necessary. Even after repeated rinses, there may be a little of the cleaner left. In order to neutralize this alkali, an acid dip is required.

The acid dip almost invariably is used on zinc die castings. It not only serves to neutralize alkali, but also gives a slight etch or matte to the surface to be plated. This slight etch seems to help the adherence of the plate to the base metal considerably.

The following acid dips are in general use:

Hydrofluoric acid	1% to 5% by vol.
Hydrochloric acid	5% to 10% by vol.
Sulphuric acid	5% by vol.

Any one of these dips may be used satisfactorily. Some time ago the hydrofluoric acid was considered best, but recently it has been found by experience that, except for a tendency of the hydrochloric acid to discolor the surface of the metal if left in the acid too long, any one of the dips is quite all right.

The work should not be left long in any of the dips. A few seconds is enough to produce all the etch or matte that is required. By all means remove the work as soon as gas bubbles appear on the surface of the metal.

The acid dip should be followed by thorough rinsing in cold running water to avoid dragging any acid into the plating solution. This would be equally bad if the solution is to be a cyanide copper where the acid would react with the cyanide, or a nickel solution, where the continued dragging in of acid would lower the pH.

The work, after final rinsing, should be kept under water until ready to plate. If much work is to be cleaned ahead it is advisable to store it under water before acid dipping, and dip and rinse just before plating to avoid discoloration.

At this point the work is ready to plate, and may be copper plated or nickel plated according to your specifications.

The copper plating may be done in either one or two steps. If the deposit is not to exceed 0.0003″ a cyanide copper bath is sufficient. If a heavier deposit is required it may be more economical, or handier, to plate for five or six minutes in the cyanide copper and transfer the work to an acid copper solution to build up the deposit to the required thickness. If the copper plate

exceeds 0.0005" it will probably be necessary to buff the copper. Copper deposits of 0.00025" to 0.0003" do not as a rule need buffing prior to depositing the subsequent nickel plate. This, however, is a matter to be determined by trial, and depends on the quality of finish required in the completed article.

The cyanide copper solution used in plating zinc base die castings is generally kept within the following limits:

Metallic copper	2.5 to 3.5 oz/gal
Free cyanide	.5 to .75 oz/gal
Carbonates	5 oz/gal maximum

Care must be taken in maintaining the solution. The free cyanide must be kept low in proportion to the metallic copper present; a ratio of about five to one is satisfactory. That is, with a metal content of 1.5 oz/gal metallic copper a free cyanide content of 0.3 oz/gal the free cyanide would be increased to 1 oz/gal with a metal content of 5 oz/gal. This ratio of metal to free cyanide results in a deposit that is free from blisters which are a source of much trouble in this job.

The carbonate content of the copper solution must also be watched closely, and not allowed to exceed much over four ounces per gallon. In general when the carbonates increase, the free cyanide must also be increased to obtain a good deposit and keep the anodes clean. In the solution used on zinc, the free cyanide cannot be increased very much without causing blistering and so the carbonates must be removed when they reach a concentration of four to five oz/gal.

There are three general methods of removing carbonates: Freezing out, precipitation, and discarding a part of the solution and replenishing with CnCN, NaCN and water. Freezing out depends on location and the season of the year. Precipitation by means of barium cyanide is costly, and discarding part of the solution is also costly. Which of the three methods is to be utilized I leave up to the individual, but insist that one of the three must be employed if continued good results are to be obtained.

The copper solution is operated much the same as any other cyanide copper used on brass or steel. The temperature should run from 100° Fahrenheit to 115° Fahrenheit, the current density from twelve to fifteen amperes per square foot.

The solution will work well over a wider range of temperatures, but lower temperatures require a lower current density, while

higher temperatures result in rapid decomposition of the cyanides, more rapid increase of carbonate content.

A tank voltage of 3 volts will generally give a current density within the above mentioned limits, but of course an ammeter is always a welcome addition. The solution is also maintained much the same as any other cyanide copper solution. Rolled copper anodes provide for replenishing the metal content as copper is deposited, although metal must occasionally be added as copper cyanide. Free cyanide, I may emphasize again, should be kept within the proper limits if good results are to be obtained. Brighteners are not to be recommended, as a bath in which the constituents are in proper proportions will work satisfactorily without any addition agents.

At a current density of fifteen amps per square foot, a deposit 0.0001″ thick will be obtained in six minutes, assuming a sixty per cent efficiency for the bath.

If, as mentioned before, an acid copper solution is to be used in conjunction with the cyanide copper, a deposit of 0.0001″ is sufficient before transferring to the acid bath. If the deposit is to be obtained entirely from the cyanide bath, an eighteen minute plate will give a 0.0003″ deposit, which is generally considered sufficient.

After copper plating, the work may be rinsed and transferred directly to the nickel, or it may be dried, buffed, cleaned and then nickel plated. Buffing is not generally necessary.

Any good nickel solution is satisfactory for depositing nickel on the die castings after copper plating, whether operated hot or cold. If the copper is unbuffed, it is best to deposit at least 0.0005′ of nickel, and this is best done in a hot nickel solution with a metallic nickel content of at least 7 oz/gal. Such a nickel bath can be operated at current densities up to 40 amps. per square foot, depending on the temperature and distance between anode and cathode.

If nickel is to be deposited directly on the zinc die casting without a primary undercoat of copper, conditions somewhat different from those encountered in plating steel or brass must be overcome. This is due to the greater tendency of zinc to dissolve in the nickel solution.

As you all know, if a zinc base die casting is immersed in an ordinary nickel solution, the zinc becomes black. This black film

is finely divided nickel that is deposited on the zinc, by the zinc passing into solution and replacing nickel, as iron does in a solution of copper sulphate. In order to prevent zinc from passing into solution and receiving this black deposit, to which subsequent electrodeposited films will not adhere, it is necessary to apply to the article, as soon as it is placed in the solution, a potential at least equal to that with which it tends to dissolve. This is equal to -0.8 volt.

If a piece of zinc is plated in an ordinary nickel solution at a low current density, part of the piece will turn black; showing that at the current density on those parts, the polarization was not great enough to prevent the zinc from going into solution. Now, if the zinc is plated in the same solution at a higher current density, a point will be reached at which no black streaks will form, which shows that the potential at all points is high enough to overcome the solution pressure of the zinc.

It is not difficult, therefore, to get from an ordinary nickel solution a satisfactory deposit of nickel on a piece of zinc, if the piece is not complicated in shape. But if the piece to be plated is irregular in shape, and we have found by trial that the minimum current density must be 25 amps. per square foot, the current density on some other part of the casting may run up to 100 amps. per square foot, and the deposit will be black and burned.

Therefore, it is necessary to employ a nickel solution in which the polarization is high, that is the cathode potential of -0.8v will be reached at a low current density, and the parts of the piece nearest the anode will not be burned.

There are three general methods employed to lower the nickel ion concentration in the film next the cathode, which increases the polarization. These are:

1. Increase the current density.
2. Form complex nickel ions.
3. Add a salt with a common ion.

Of these methods the first and third are most commonly used now. The second method, that of lowering the nickel ion concentration by forming complex nickel ions by additions of sodium citrate or tartrate, works well for a time, but the solution is difficult to control by analysis, and has relatively poor throwing power. This solution is also a handicap when the time comes to

precipitate out the zinc, or destroy detrimental organic material that may have found its way into the bath.

The third method, that of adding a common ion to decrease nickel ion concentration, is one generally followed. This consists in adding sodium sulphate in varying amounts, depending on the irregularity in the work to be plated. It increases the conductivity of the solution, also. The maximum amount of anhydrous sodium sulphate that may be added is 28-30 oz/gal. This solution is nearly saturated at room temperature, and if the solution should fall below 70° Fahrenheit on cool nights, some of the sulphate will crystallize out; as a result, the work will be streaked. The sulphate is difficult to redissolve.

There are three nickel solutions in common use, each of them depending on conditions obtaining in the individual plating room. The amount of nickel required to deposit, the kind of tanks available, and the generator capacity which limits the current density, are conditions which must be taken into consideration.

The first of these solutions is:

8 oz/gal	Single nickel salts
3 oz/gal	Ammonium chloride
12 oz/gal	Anhydrous sodium sulphate
2 oz/gal	Boric acid

This solution is operated with a moving cathode, at room temperature with a current density of ten to twelve amperes per square foot. The pH should be maintained at 5.8 colorimetric. If the parts streak or blacken a bit an initial strike current must be applied for a few seconds. This strike may run up as high as twenty-five amps per square foot. To obtain a plate 0.0003" thick with this solution the plating time must be at least twenty-eight minutes at twelve amperes per square foot.

The second solution also operates at room temperature, but allows somewhat higher current densities.

10 oz/gal to 12 oz/gal	Single nickel salts
15 oz/gal	Anhydrous sodium sulphate
3 oz/gal	Ammonium chloride
3 oz/gal	Boric acid

Temperature 70° Fahrenheit

pH 5.8 colorimetric
Current density 15 amps/sq. ft to 20 amps/sq. ft.
The cathode must be agitated.

With tnis solution a 0.0003″ plate will be obtained in twenty-five minutes at 15 amps., and nineteen minutes at 20 amps/ sq. ft.

The third solution is as follows:

14 to 16 oz/gal	Single nickel salts
15 to 20 oz/gal	Anhydrous sodium sulphate
3 oz/gal	Ammonium chloride
3 oz/gal	Boric acid

Temperature 90° Fahrenheit
pH 5.8 colorimetric
Current densities up to 30 amps/square foot.
The cathode must be agitated, and unless the piece has deep recesses no strike current is necessary.

At 30 amps/square foot a 0.0003″ deposit will be obtained in 12.5 minutes.

The solution is best adapted to use in a semi-automatic line-up as the work does not require any strike current. If a strike is necessary, an auxiliary rod can be rigged at the end of the tank by the plater, and the work given a short strike before being placed on the conveyor. If the work is to be plated in an ordinary nickel bath after receiving a light deposit in a strike solution, as is often the case, this last solution is the best to use. If the work is plated for three minutes at 40 amps/square foot, it may tnen be plated in an ordinary nickel batn, although occasionally it is advisable to add eight or ten ounces/gal. of sodium sulphate to the bath. All above solutions require moving cathodes.

In any of the tnree baths mentioned above, tne concentration of anhydrous sodium sulphate may be varied somewhat depending on the shape of the pieces to be plated. The plainer the piece the less sodium sulphate required. The bath should contain enough sodium sulphate to prevent the most complex piece you expect to encounter from streaking under ordinary conditions.

In all the batns mentioned, the current must be on when the work is immersed in the solution. The plater will soon determine the best way to operate his rheostat to keep the work from streaking and prevent burning. If the tank is operated so that the whole load is plated, removed, and another load put in, he should,

when loading the tank, keep some current on the work. As he puts in more racks he should raise the current until, when the whole load is in, he should apply the full required current to the load. In unloading the tank a reverse process should be followed.

The maintenance of die cast solutions is in general similar to the procedure followed in ordinary nickel baths, with a few exceptions. The plater should be very careful not to allow work that may have fallen off the racks to remain in the solution. It is a good practice to make sure no work is on the bottom of the tank every night, whether any losses have been noticed or not. If the nickel solution is filtered frequently and the anodes are bagged, there can be no danger of pitting from stirring up sludge when the plater goes over the bottom of the tank.

The pH should be maintained by frequent checking by whatever method is available in the plant. A bath with a high pH is likely to give a dark brittle deposit that cracks badly if the plate is over 0.00025". A bath with a pH too low is very liable to pit.

If pitting occurs, it can generally be traced to one of the usual sources found in ordinary nickel baths. High current density, high acidity, a low metal content or dirt in the solution are all frequent causes of pitting. Dirt must be removed by filtering; the remedies for the other causes are to eliminate the offending condition. Pitting which is not cured by lowering the current density or raising pH can generally be eliminated by additions of hydrogen peroxide.

The peroxide should be diluted, if it is the 100 volume or 30 per cent peroxide, to about 10 per cent and added to the bottom of the solution. This can be done by using a long-stemmed funnel which reacnes nearly to the bottom of the tank. This allows the peroxide to work up through the solution and do some good.

There is one other source of trouble to be encountered in nickel solutions used for plating die castings; that is when the solution becomes, unavoidably in many cases, contaminated with zinc. Mr. E. A. Anderson, of New Jersey Zinc, says that 0.3 grams per liter of zinc will cause streaking of the plate.

The general method of removing this objectionable zinc is to raise the pH of the solution to 6.8 colorimetric, and the temperature to 140° Fahrenheit. When the solution has been neutralized the zinc will be precipitated, but the precipitate tends to remain

suspended in the solution. If about one-third ounce per gallon of freshly prepared basic nickel carbonate is added to the solution, the precipitated zinc along with iron and aluminum, if they are present, will be carried to the bottom and may be readily filtered out. The nickel carbonate is prepared by adding one part of sodium carbonate to seven parts of single nickel salts dissolved in a minimum of water.

If organic material is present, potassium permanganate may be added instead of the basic nickel carbonate. The permanganate is reduced in the oxidation of the organic matter, and the resulting manganese dioxide will carry the zinc down.

Either of these methods of removing zinc is efficient and can be carried out with very little trouble, and will produce excellent results.

I have had no experience in plating chromium directly on die castings, and so I do not feel qualified to mention this phase of finishing them. (Applause)

CHAIRMAN CHAMBERLAIN: Is there any discussion on this paper? Do you have any questions, gentlemen?

MR. CALDWELL: You spoke of three acids that could be used. Do you feel there is no preference, that any one is as good as the other?

MR. COSTELLO: If you are careful in the use of the hydrochloric acid, I think it is the one that is generally used. I know it is the one I use, personally.

MR. CALDWELL: You see no advantage in using hydrofluoric over hydrochloric?

MR. COSTELLO: If hydrochloric is dragged into the solution, it has a tendency to lower both your anode and cathode efficiency. If you are careful in rinsing it off, it can be used with equal success.

MR. CALDWELL: You said almost any cleaner that rinses well can be used successfully. What compounds in cleaners would you state as being those that don't rinse well?

MR. COSTELLO: I am not familiar with the analysis of many commercial cleaners, but I do know they use some complex silicates or soaps that might make rinsing difficult. I have run into the trouble, but I would not want to say what cleaner it was.

CHAIRMAN CHAMBERLAIN: Are there any further questions, gentlemen? Thank you, Mr. Costello. (Applause)

Rustproofing Process Utilizes Alternating Current

AN entirely new method of rustproofing which utilizes alternating current in the process, has been perfected by the Ford Motor Co. and is now being used in its entire production of head and tail lamps at its lamp plant at Flat Rock, Mich.

The new process is considered by Ford chemists as especially suitable for use in the Flat Rock operation, as it requires less room than other methods of rustproofing, and provides a surface which is ready for painting as it comes from the rustproofing machine. The only attention required before painting is to wipe off the surfaces to be painted with a clean cloth.

The process was developed first outside the Ford organization, but when it was given its first commercial tryout in the Flat Rock plant a number of difficulties developed. The most important of these was deterioration of the steel surface by acid action before the deposition of the rustproofing agent, zinc phosphate, began.

It finally was overcome by discontinuing the elaborate washing operation which preceded the actual rustproofing. Instead of washing the lamp shells in a machine they are made *dirty* instead by wiping the surface to be painted with a cloth impregnated with low-grade gasoline. This puts an oily film on the surface and by the time the chemical action in the rustproofing machine has removed this film the deposition of zinc is well under way and the desired smooth finish is obtained.

The rustproofing machine, or rather machines, for two units are in use, are entirely automatic. The burnished lamp shell, with its oily film is hung on a conveyor which carries it into the bath, where it stays for 4½ minutes. The bath is kept at 155 degrees Fahr., and an alternating current of 20 volts, pulling from 35 to 50 amperes at 60 cycles, alternately makes the article to be rustproofed an anode and then a cathode.

After 4½ minutes in the bath the conveyor takes the rustproofed articles to a hot water spray rinse and dip rinse, and then carries them to the paint booth, where they are dip painted at once after being wiped off with a clean cloth.

A feature of the process is that the proportion of metallic zinc in the bath can vary widely and still permit of satisfactory results. It is allowed to vary from 0.9 per cent to 0.2 per cent.

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The process is not thought to be suitable for large pieces, such as fenders, because the oily-wiping operation by hand is probably not economically feasible for very large articles. Rust-proofing methods previously used are therefore being continued for large surfaces.

The Research Committee

We feel that the present members of the Research Committee know what it is all about, that they functioned very efficiently last year, therefore, they are requested to again serve on this most important Committee.

At the Bridgeport Convention it was reported that about one-third of the specimens for the new exposure tests had been plated. Since then satisfactory progress has been made and about half of the total number are now finished.

This progress has been made possible only by the continuous services of the Research Associate, Mr. P.W.C. Strausser, and of his Assistant, Mr. C. K. Fewell. In addition it has been found possible to re-assign to the electro-plating section Mr. A. Brenner, who helped to prepare the specimens for the first tests, but was transferred to another section two years ago. His services will not only hasten the completion of the present program, but will also make it possible to give more attention to related topics, such as the measurement of thickness and distribution of the coatings on these and other specimens. Such measurements are especially necessary now in order to apply the recently adopted specifications that include a requirement for minimum thickness.

To insure the completion of this program, including accelerated and other laboratory tests, the continued cooperation of the American Electroplaters' Society is very necessary. One way for each plater to convince his employer of the value of such researches and of the justification for subscribing to the Research Fund, is for him to become familiar with the results already obtained, and with the tentative specifications, and to apply them whenever opportunity offers.

The ultimate value of any such research work depends on the extent to which the results are put into practice.

Another way to help the research work is to send comments

and suggestions to some member of the Research Committee, which has the following membership.

W. M. Phillips, Chairman, General Motors Corp., Detroit, Mich.
Walter Fraine, Sec.-Treas., 507 Grand Ave., Dayton, Ohio.
Van Winkle Todd, Hanson-Van Winkle-Munning Co., Matawan, N.J.
O. B. J. Fraser, International Nickel Co., 67 Wall St., New York City.
Erwin Sohn, Standard Sanitary Co., Louisville, Ky.
B. H. McGar, Chase Companies, Waterbury, Conn.
W. R. Meyer, General Electric Co., Bridgeport, Conn.
G. B. Hogaboom, Hanson-Van Winkle-Munning Co., Matawan, New Jersey
Jos. Sexton, Sargent Co., New Haven, Conn.
Carl Huessner, Chrysler Corporation, Detroit, Mich.
Claude S. Tompkins, J. B. Ford Sales Co., Chicago, Ill.
E. A. Anderson, New Jersey Zinc Co., Palmerton, Pa.
W. Blum, Bureau of Standards, Washington, D. C.

THOS. F. SLATTERY, *President.*

FROM ACROSS THE POND

Electrodepositor's Technical Society

George B. Hogaboom, Esq., August 28, 1935
557 Stanley St.
New Britain, Conn.

Dear Mr. Hogaboom:

Your letter of the 20th instant has duly arrived preceded by the imposing volume containing the proceedings of the Convention of the American Electro-Platers' Society, for which please accept my warmest thanks. It is indeed very good of you to have forwarded this so promptly and I have already spent an absorbing hour or two perusing some of the contents. I must congratulate your Society on the high standard of production and it is particularly interesting to note that your members are evidently closely studying the new methods of research opened up by diffraction work.

It is particularly interesting to me to read the verbatim discussion which took place on some of the papers since it creates a very real picture of the atmosphere of the Convention.

I have been in touch with the Faraday Society and I understand that they are about to issue the volume containing the full report of the Conference held last March. The address of the Secretary is Mr. G.S.W. Marlow, B. Sc., F.I.C., Faraday Society, 13, South Square, Gray's Inn, W. C. 1. London.

With kind regards,

Yours sincerely,
S. Wernick, Honorary Secretary.

Hon. Secretary,
Dr. S. Wernick,
3, Grosvenor Rd.,
Highbury, N 5.

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The Abstract Section

PATRICK J. SHEEHAN, *Chairman, Program and Educational Committee*

The Co-Deposition of Nickel and Iron, E. RAUB and E. WALTER. *Mitt. Forschungsinst. Probieramt Edelmetalle* **9,** 17-21 (1935)—Previous studies had shown that deposits containing nickel and iron can be obtained with low cathode efficiency from baths with a pH. of 3. Salts of alkyl naphthalene-sulphonic acids prevent pitting. By increasing the bath temperature to 70 to 100°C (158 to 212°F), the content of hydrogen in the deposit is decreased and that of nickel is increased. At low temperatures the ratio of nickel to iron in the deposit is less than that in the bath, while at temperatures above 70°C the ratio is reversed. For example at 100°C (212°F) there is only 5.5 percent of iron in a deposit from a bath of which 55 percent of the metal content was iron. Increase of bath temperature decreases the pitting and improves the mechanical properties of the deposits. The later are porus and give very little protection against corrosion, even with an intermediate layer of copper. Through *C. A.* **29,** 5749 (1935). W. BLUM

Testing Electroplated Metals, A. GLAZUNOV, *Chem. Listy,* **28,** 302-5 and 313-15 (1914)—The thickness of coating may be measured metallographically. Test papers soaked in suitable reagents were used to detect pores or unplated spots. The spots with minimum thickness were detected by anodic treatment in a neutral salt solution containing some reagent that would react with the base metal when exposed. The thickness of such spots was calculated from the time and anodic current density. Examination of the stripped surface for pits, etc., gave an indication of the uniformity of the deposit. Through *C. A.* **29,** 5750 (1935). W. BLUM

Throwing Power I—The Method For Its Determination and Its Definition, Y. OGAWA and E. NISHIKATA, *J. Electrochem. Assoc.* (Japan) **3,** 149 (1935)—The throwing power of acid copper sulphate solutions was determined in a cell with both cathodes on the same side of the anode (a modification of the cell proposed by Field). At 30°C (86°F) and an average current density of 10 amp/ft^2, the throwing power increases as the content of sulphuric acid is increased. With 2 N sulphuric acid (13 oz./gal. H_2SO_4), as the content of copper sulphate is increased, the throwing power first decreases and then increases. Through *C. A.* **29,** 5750 (1935), and inspection of drawings in original paper. W. BLUM

Electrochemical Deposition of Binary Alloys (Brass), V. A. SUKHODSKII, V. L. KHEIFETZ and I. N. CHAPURSKII, Repts. *Central Inst. Metals* (Leningrad) **17,** 209 (1934)—Brass deposits 0.0004 inch thick were produced on iron in a bath containing zinc sulphate, copper sulphate, tartaric acid, and sodium hydroxide, using brass anodes. Through *C. A.* **29,** 5337 (1935). W. BLUM

Electrodeposition Exhibition. *Metal Industry* (London), **47**, 115 (1935)—A brief account is given of a very complete and interesting exhibition of electrodeposition in the Science Museum, London, on July 25, 1935. This was organized by the Electrodepositors' Technical Society with the cooperation of various firms and organizations. The exhibits include the principles of electrodeposition, plating supplies, equipment, applications, deposition of precious metals, heavy deposits, electroforming, printing plates, coinage dies, and electrolytic refining. W. BLUM

The Electrophoresis of Rubber, by M. MATHIEU BULL, *Soc. Francaise des Electriciens*, p. 821, August (1935)—Beginning with 1925, the electrolytic coagulation of rubber directly from latex has often been employed for producing molded objects, sheets of rubber, and for coating certain articles. The process is simple and gives an excellent quality of rubber, ready for vulcanizing.

A typical bath contains one-third volume of latex in a solution of 20 g/l (2.7 oz/gal.) ammonia and 30 g/1 (4.0 oz./gal.) ammonium salts. Potassium and sodium salts are sometimes used. Materials for vulcanizing, certain additions to modify the physical properties, and pigments, all in powdered form, are emulsified in oil, usually with an added colloid, as gum arabic. These are added, for example, in such proportions as sulfur 1.2%, zinc oxide 1.3%, accelerator 5.6%.

At the anode, where the coagulation occurs, the liberation of oxygen or the formation of harmful oxides, as of copper, must be guarded against. Lead, zinc, and cadmium, whose oxides are useful additions to rubber, are preferred metals. Iron, nickel, and chromium foster oxygen discharge, and rapid polarization occurs. Porous diaphragms of plaster of paris or porcelain are often used to permit removal of oxygen. Reducing agents, as sulfite, may be added to the bath.

Voltages ranging from 10 to 100 volts are used, with current density usually around 0.4 or 0.5 amp/dm^2 (3.8 to 4.8 amp/sq. ft.). The concentration of latex is maintained at from 30 to 35%. Relative thickness of deposit may be controlled by shielding. The pH of the bath is of the utmost importance.
C. T. THOMAS

On the Hardness of Electrolytic Chromium and the Influence of the Hydrogen Dissolved Therein. (Über die Härte des Elektrolytischen Chroms und über den Einfluss des im Metall gelösten Wasserstoffs). S. P. MAKARIEWA and N. D. BIRUKÖFF. *Zeitschrift für Elektrochemie* Vol. 41, No. 8, 1935, 623-631—It has long been believed that the hardness of electrolytic chromium was associated with the presence of dissolved hydrogen. These deductions were erroneously arrived at by various investigators because the temperatures employed to remove the hydrogen were sufficient to cause either recrystallization changes in the chromium or a removal of strains in the metal. The authors made a careful study of the relationships between scratch hardnesses and the hydrogen contents of thin chromium deposited under conditions similar to those of commercial plating. At 100°C, chromium lost only 16% of the dissolved hydrogen; at 200°C, 66%; at 300°C, 83%; and was entirely removed at 600°C. The scratch hardness values instead of decreasing as the

hydrogen was removed, actually increased slightly. The small increase in hardness of the chromium was attributed to a change of the softer hexagonal lattice into the harder face-centered cubic structure. At 575°C, plus or minus 20°C, after all the hydrogen had been removed, a pronounced drop in the hardness of the chromium occurred which was attributed to a relieving of the strains present in the deposit or to a recrystallization of the chromium.

Other investigators have found similar critical temperatures for other electroplated metals at which a sudden drop in the hardness of the metal could be observed when heated to its particular critical temperature. The value for iron is 265°C, for nickel is 400°C, and for cobalt is 450°C. The temperature, however, to which our regular nickel-chromium deposits must be heated to get a marked decrease in hardness would be the critical temperature of the nickel, the physical nature of which strongly pre-dominates because of its much greater thickness than that of the chromium. WALTER R. MEYER

Polishing Aluminum Castings. By FRED B. JACOBS. *Metal Cleaning and Finishing*, August, 1935—The author suggests five abrasives he has found effective. These are Turkish emery, Naxos emery, American emery, natural corundum, and manufactured alumina. A long process puts the work through a sequence of nine wheels, three dry, and six grease wheel operations. The grit size ranged from No. 46 to 220 and F., in successive operations. This is frequently reduced to three or four wheels, depending on cost, and type of finish desired. E. SHEEHAN

1. Influence of various Acid Radicals on Chromium Hardness. By R. J. PIERSAL, Ph.D. *Metal Cleaning and Finishing*, August, 1935—A series of tests was conducted using a mixture of sulphate and nitrate radicals. Results indicated that the use of the nitrate radical in no way benefited hardness of the deposit. Further tests with a mixture of fluoride, chloride, nitrate, and sulphate radicals appeared promising. However, the bath lacked stability. E. SHEEHAN

MISCELLANEOUS ABSTRACTS
PHIL J. RITZENTHALER

1. Corrosion of Steel by Sulphuric Acid.
S. RAM. *Journal Society of Chemical Industry*, vol. **54**, April 19, 1935, pp. 107-T to 109T. Laboratory studies made to determine influence of acid concentration and dissolved iron on the rate of corrosion of steel. Solutions of sulphuric acid of various concentrations were saturated with iron sulphate. Results show that steel corrodes most when acid concentration is more than 100 ounces per gal., when viscosity of liquid is decreased and when there is movement in liquid. Presence of iron sulphate seems to have little effect.

2. Finishing Cast Aluminum, J. F. GREENE. *Industrial Finishing*, vol. **10**, June, 1934, p. 25—Contains description of various methods of finishing cast aluminum parts.

3. Electrolyte used with Current Shortens Pickling. *Iron Age*, vol. **135**, June, 1935, p. 58—New pickling process developed at Ferro Enamel Corporation depends on chemical pickling with sulphuric acid and electrolytic action in an electrolyte composed of an organic acid (gluconic acid) as well as an inorganic acid. The parts to be pickled do not form part of the electrical circuit. Purpose of electrolysis is to regenerate the sulphuric acid from iron sulphate. Advantages are longer life of pickle, lower acid cost and better finish obtained on metal more rapidly.

4. Tumbling and Burnishing, H. R. SIMMONS. *Iron Age*, vol. **135**, March 28, 1935, pp. 25-27—Article describes various features affecting proper selection of equipment, various kinds of abrasives and describes various processes to use.

5. Sand Blasting. *Industrial Finishing*, vol. **9**, June, 1935, pp. 35-36—Brief discussion of blast method of cleaning of metallic surfaces, including types of work done, factors affecting results, safety of workers and reconditioning abrasives.

6. Deposition of Iron for Wearing and Bearing Metal., DAVID R. KELLOGG. *Metals and Alloys*, vol. **6**, April, 1935, pp. 97-99—Describes bearing and wear characteristics of electrodeposited iron. Such coatings have been used to repair shafts, gauges, etc., and have given excellent results in service.

Cold Bath.

Ferrous ammonium sulphate—10 oz. per gal.
Current density—3 amps. per sq. ft.

Hot Bath.

Ferrous ammonium sulphate—40 oz. per gal.
Temperature 100-200 degrees F.
Current density—60 amps. per sq. ft.
Addition of charcoal and ferrous carbonate mud are beneficial. Hot bath is better as it is faster and more ductilo deposits obtained.

7. Commercial Production of Beryllium, E. R. LARSEN. *Mining Congress Journal*, vol. **21**, April, 1935, p. 26—A pilot plant for production of 200 lbs. of Be has been built in U. S. Beryllium alloys for airplane construction show twice the strength for ¼ the weight of Steel.

Beryllium may be electro-plated on copper, nickel, iron and aluminum. By controlling temperature of fused bath and subsequent heat treatment, the deposit will alloy with base metal.

8. Metals in Food Industry, N. D. Sylvester. *Synthetics and Applied Finishes*, vol. **5**, Feb., 1935, p. 277—Recent developments of cadmium plating have made a new addition to metals prohibited by food industry, as cadmium has a marked poisonous effect. Copper is bad, but tinned copper or tinned metal is o. k. Chromium plating may have some application, but usage not developed. Silver plating excellent, especially to acetic acid and other fruit acids, but cost is factor.

Polishing Intensifies Sales Appeal of Hoover Products, F. B. JACOBS. (*Iron age*, vol. **136,** No. 11, pp. 20-23, Sept. 12, 1935) — Description is given of the mechanical equipment used for polishing aluminum vacuum cleaner parts. This consists of disk grinders, belt sanders, semi-automatic machines, and hand buffing. Some equipment has been designed for this work.

Information is also included on the various grits used for the polishing.

E. T. C.

Finishing Motion Picture Cameras and Projectors, C. A. ZIEBARTH. (*Iron Age*, vol. **136,** No. 7, pp. 16-19, August 15, 1935)—Parts of Motion Picture Cameras and Projectors consist mainly of aluminum castings. These castings are all normalized at 450° Fah. to remove casting strains before machining. After machining they are baked at 400° Fah. to remove oil. They are then given a sprayed coat of rubber finish enamel for good adherence and baked at 350° Fah. for 30 minutes. They are then sprayed with damasken finish which is a dull oil base finish. This is baked at 200° Fah. for 20-30 minutes, then the finish expands and becomes wrinkled.

Where colors are required, they are sprayed on the damasken finish. Colors consist of either black, bronze using bronze powder, or silver using aluminum powder.

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Industrial Cleaning Materials and Methods

Business and Social News

BRANCH NEWS

Educational Activities

DETROIT BRANCH

The regular meeting of the Detroit Branch, American Electroplaters Society, was held on September 6, 1935, (Friday evening) at 8:00 P. M. at the Hotel Statler. Mr. W. W. McCord presided. The minutes of the previous meeting were read and approved. The two following applicants were elected to membership:

Mr. Robt. A. Stoll, 1530 E. Hancock Avenue, Detroit, Mich.

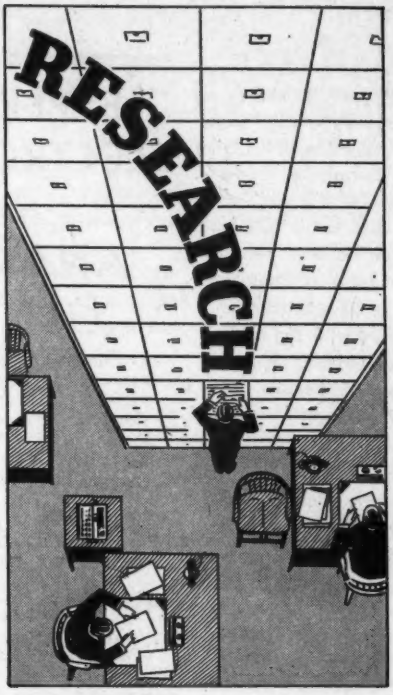
Mr. James L. Germaine, 5922 Commonwealth Ave.

There being no other special business to come before the meeting, the reports of the delegates to the Convention in Bridgeport, June 10th to 14th inclusive were asked for. We first heard from Mr. M. Cherry, who gave a report of the entertainment furnished by the Convention Committee. He gave a very good report. Detroit Branch being very well represented in all the games, races, etc. and came home with quite a number of the prizes. He also stated that the ladies especially reported that they were very well pleased with the way the entertainment program was carried out for them. They also came home with a good supply of favors, and he stated further that any committee in the future would have to extend itself very much indeed to even come up to the Bridgeport Convention. The baseball game which was played between the East and West came out in a tie. One participant in the baseball game broke his arm sliding into third. Otherwise there were no untoward happenings and everyone was well pleased with the way things turned out.

Mr. A. Gordon Spencer gave a report on the educational program carried out by the Educational Committee. He gave quite an elaborate synopsis or extracts from the different papers. I do not intend to repeat them herewith as they have been quite extensively reviewed in the July issue of the REVIEW and everyone can avail himself of them there. Mr. Gordon remarked the wonderful value contained in the different papers that were presented, both technical and practical, some technical papers of course being very much technical insofar that they were understood by but a few, but the principal interest was taken in the papers of the practical platers. His report was very well presented, and very interesting to all present. He was given a rising vote of thanks.

The next report was given by your Secretary, and it was wholly on the business part of the Convention. It was not possible in the short time allowed for this to give very much of the business proceedings as they happened, but the principal actions taken by the Convention were given according to the way they were enacted at the Convention. All in all, the report was very well accepted and a rising vote of thanks was given for the way in which it was presented.

Your Secretary also reminded the members that the delegates to the Convention did their utmost to be on the job continually and to bring back as good a report as possible, and the expression of the meeting shows those present appreciated this fact.



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Please mention THE MONTHLY REVIEW *when writing.*

Mr. Eichstaedt then remarked regarding the printed report of the Convention, which includes every word spoken and every paper read at the Convention. This is quite a voluminous book, about the size of a telephone directory and as a rule are ordered at the Convention. They cost $3.00 plus delivery charge of $.25, and can be obtained by simply writing to the Secretary for one. They will be mailed C.O.D. However, it is not known how many can be obtained at this late date. They should be ordered at the Corvention.

There being no further business, Mr. McCord, the chairman, outlined work and programs for the future meeting during the coming year; he also stated he trusted every member would consider himself a committee of one to bring in more new applications, as the action at the Convention now allows taking in Assistant Foreman platers, and there is no reason why we shouldn't double our membership.

The meeting adjourned at 10:20 P.M.

T. C. EICHSTAEDT
Secretary-Treasurer.

CHICAGO BRANCH

The regular monthly meeting of Chicago Branch was held Sept. 14, 1935 at the Atlantic Hotel, President F. Herbst presiding and all other officers present.

Mr. R. Harr was granted a transfer from Chicago Branch to Detroit Branch.

At our August 10th meeting Mr. O. E. Servis presented our Past President Mr. E. G. Stenberg with the Prize Certificate of Award that Mr. Stenbergs Crowe Name Plate & Mfg. Co. exhibit won at the Bridgeport Conn. convention. Chicago Branch is very proud of the fact that Mr. Stenberg won this certificate and hope that more of our members will try and win these very valuable certificates.

It was decided that Chicago Branch hold its Annual Banquet this year and a committee was appointed on same.

Mr. F. Romanoff is confined at the St. James Hospital Chicago Heights and all the members of Chicago Branch wish to extend their sympathy to Mr. Romanoff and hope for his rapid recovery.

Mr. C. E. Tompkins urged all members to attend the National Metal Exposition held at the International Ampitheatre 43 and Halsted Sts., Sept. 30, Oct. 1, 2, 3, 4. Both Mr. Tompkins and Mr. Davies offer to furnish free tickets to all members wishing to attend.

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The librarian Mr. O. E. Servis found the following questions in the question box:

No. 1. *What is a good nickel strip for Zinc Base Die Castings?*

Answer. Use the regular Sulphuric strip, about 5% Beaume with reverse current.

No. 2. *Can you put too much Boric acid in a nickel solution? If so what damage does it do? How can you test for boric acid?*

Answer. Yes you can use too much boric acid if you use too high a Metal content in a hot solution. This may cause cracking, but in a cold solution no danger is experienced. Determination may be made by using Methyl Red in glycerine using N a O h as a titrator.

No. 3. *On pickling steel stampings on cadmium plated racks how can you remove the black smudge or avoid the smudge which is caused by dipping the racks in the pickel again?*

Answer. Put in a cyanide solution for a few minutes with reverse current.

No. 4. *What makes the chrome plate too blue in color?*

Answer. There are many things that can cause this. But the main causes are too high a temperature, too high current density also a slight break in the current can cause this.

In spite of this very hot evening this meeting was very well attended and the members not attending are losing out on some very interesting and instructive discussions.

Mr. C. Tompkins at the request of Mr. Servis read a very interesting article "Rustproofing Process Utilizes Alternating Current" after a short discussion on this article, Mr. Tompkins was giving a vote of thanks for reading this article and Mr. Servis a Vote of thanks for bringing this article to the meeting. J. W. HANLON, *Sec'y.*

CLEVELAND BRANCH

The regular monthly meeting of the Cleveland Branch of the American Electroplaters Society was held Saturday, August 25th, at Hotel Carter. The meeting was called to order by our president Mr. W. D. Scott at 8:15 p.m.

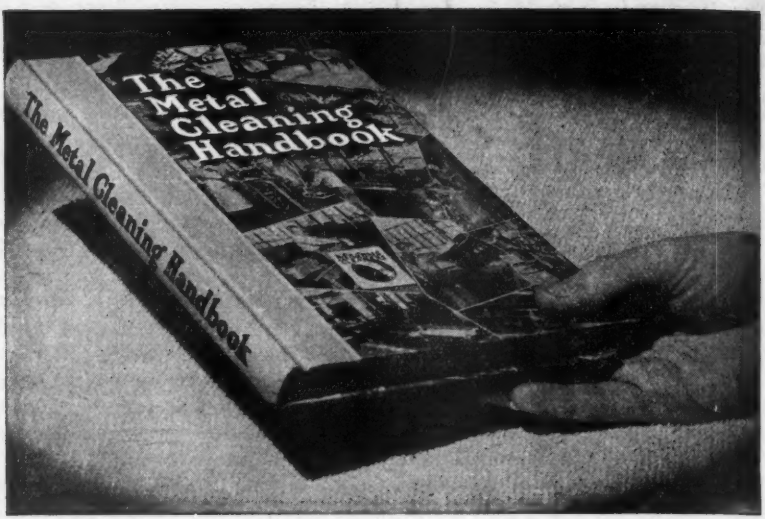
The minutes of the July meeting were read, there being an error of the 1936 convention dates instead of June 9th to 11th inclusive, they should read June 8th to 11th inclusive. After correction minutes were approved as read. Application for associate membership was made by Mr. Charles Anger of the Udylite Corporation.

Mr. Singler, Chairman of the Hotels and Reservations Committee reports that he is still shopping and that he will have a meeting with Mr. Alguire of Hotel Cleveland, Friday, September 13th, who will show Mr. Singler and his committee some new arrangement of space which can be used providing Hotel Cleveland is selected as convention Headquarters, and that at the next meeting he would have something definite to report.

Mr. Thompson, Chairman of the Advertising Committee reports that everything is progressing very fine, he was given full authority to act on all advertising.

On a motion made by Mr. Singler and seconded by Mr. Ter Doest, that the Convention Chairman have their stationary separate from the Branch stationary for their correspondence. Voted on and carried.

On a motion made by Mr. Lyons that the Branch turn over $100.00 of their fund to the Convention Treasurer, to be used as a checking account for Convention purposes, and that a separate ledger be kept for receipts and disbursements of the Convention, was seconded and vote carried.



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Written by Robt. W. Mitchell, Ph.D., The Magnus Technical Director, "THE METAL CLEANING HANDBOOK" is intended to provide a ready reference and guide for the use of those directly interested in or concerned with metal cleaning.

To these, a limited number of copies are available. A request on your business letterhead giving your official title or position will bring a copy. To all others, a copywill be sent on receipt of the nominal sum of $1.00 to cover cost of publication.

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Our president then appointed Mr. Richard Hull as Chairman of the Transportation Committee and Mr. P. R. Lyons as Chairman of the Banquet Committee. The fellow members then thought that our president Mr. W. D. Scott was getting off kind of easy, so he accepted to be Chairman of the Entertainment Committee. The secretary Mr. William O'Berg was then ordered to give the names of the various Chairmen to Mr. Thompson so that he would be able to have the stationery printed.

A letter from The American Society for Metals was then read, in which they state their program and request a list of our members so that they may send copies of their programs to our members. Their meetings are about electroplating and should prove very interesting to our members.

Learning of our 1936 Convention they wrote as follows: "Our mutual interests may well lead to cooperation at these times and shall be glad to discuss the matter at our earliest convenience."

On a motion made by Mr. Ter Doest and seconded by Mr. Thompson, the secretary, Mr. William O'Berg was then instructed to give The American Society for Metals, the membership list and to further explain our 1936 Convention.

After some discussion in sand rolling and burnishing the meeting adjourned.

WILLIAM E. O'BERG, *Sec'y-Treas.*

WATERBURY BRANCH

The November meeting of Waterbury Branch A.E.S. was held Friday, the 13th with a good attendance. President Tennant Elwin presided. Communication from Newark Branch relative to their annual picnic and outing was read. Communication was read from the Waterbury Provisional Anti-Sales Tax Committee. Set of resolutions were also received and commented upon. Several interesting subjects including cleaning, plating and ball burnishing were brought up for discussion and various ideas were expressed as to the methods to be used for obtaining the best results.

Ellsworth Candee, chairman of the committee on speakers, outlined a program which will undoubtedly be the means of bringing out the entire membership and visitors during the coming months. The first speaker assigned will be Walter Meyer of the Bridgeport Branch, who has promised an interesting talk on a popular subject at the next meeting, which will take place Friday, October 11th.

The many friends of James Egan well-known in plating circles, will learn with regret, of his death, which occurred in this city recently.

W. F. GUILFOILE, *Sec'y.*

ANDERSON BRANCH

The first meeting of the Anderson Branch under the new officers was held Monday, September 16th, at the Y.M.C.A.

Twenty-five members and guests enjoyed dinner at 6:30 P. M.

After dinner, President Castell led a lively discussion of plans for the coming year. Mr. George Onksen, treasurer, put in a strong plea for a worthwhile question-box, the questions being read and not answered, being referred to the Education Committee and their findings reported at the next meeting. The suggestion was well received.

Mr. G. S. Cole, Supervisor of Plating and Enameling, Guide Lamp Corporation, gave a very interesting address on "Bright Nickel Plating", bringing in phases of its history, different uses, advantages and disadvantages and means employed in its application on

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brass and steel parts. Members kept Mr. Cole busy for sometime answering questions relative to this newest development in the art of electrodeposition.

An invitation was made to Mr. J. T. Rowe, of the Aladdin Industries, Alexandria, Indiana, and to Mr. J. R. Taylor of the Rutenber Electric Company, Marion, Indiana, to present papers of their own choosing in the near future. The invitations were accepted.

Meeting adjourned at 9:30 P. M.

J. W. MINTON, *Sec.*

HARTFORD BRANCH

The Hartford Branch of the A.E.S. held its first fall meeting on Monday evening, Sept. 15, 1935, at the Hartford State Trade School, Hartford, Conn.

The meeting was called to order at 8.30 P. M. with President St. Pierre in the chair. Minutes of the previous meeting were read and accepted. All communications were read and placed on file. One transfer, to Mr. Frank J. Clark, Associate member, from the Hartford to the Springfield Branch, was granted. One resignation of Active member, Mr. Geo. Vibherts was accepted. Mr. Vibherts resignation was due to poor health and inability to attend the meetings.

Various ways of increasing our membership, as well as increasing the monthly meeting attendance was discussed.

A "question box" was definitely made a part of our regular monthly meetings.

Plans were discussed for a forming of a definite program for the winter. Among the various plans discussed was the securing of capable speakers, as well as the presentation of educational papers.

The meeting was attended by fourteen members and was adjourned at 10.30 P. M.

V. E. GRANT, *Sec'y*

ST. LOUIS BRANCH

Regular Meeting of St. Louis Branch A.E.S. held Friday, Sept. 13, 1935. Minutes of previous meeting read and approved. This was our first Meeting of the year, and had a very good attendance. Hope to have more at our next Meeting which will be held Oct. 11, 1935, at Central Y.M.C.A., at which time a dinner will be served.

We hope to have Dr. L. W. Stout, Chemical Instructor at the Washington University to give us a short talk. He is well known to the Electro Platers for his papers that appear in the different magazines that are published, and he is well versed on the subject of Electro Plating: so do not miss this Meeting.

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C. T. MCGINLEY, *Sec'y*

PHILADELPHIA BRANCH

The Philadelphia Branch had a very good attendance at their Sept. 20th meeting, and we hope for a continuance of the same during the winter season. Dr. E. B. Sanigar of the branch gave a very interesting story on Chemistry and Electroplating. At our next meeting, October 25th, Mr. Jackson, Ch. of the Educational committee will have a speaker to give a talk on Lacquers and Enamels and the application of the same. Ch. Reynolds of The Yearly meeting and Banquet on Nov. 23, 1935, reports the committee is doing everything to make this affair the largest and best we ever had.

Three applications were received viz —

Paul Mentzer, 138 W. Godfrey Ave., Philadelphia, Pa., Active.

Harry Keller, 4742 Benner St., Philadelphia, Active.

Frederick Fulforth, Box 96, Roslyn, Pa., Active.

Elected to Active membership.

John L. Nelson, 1717 North St., Philadelphia, Pa.

Died — Sept. 12, 1935.

John A. Storm, 1044 Third St., Fullerton, Pa.

GEORGE GEHLING, *Sec.*

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Is It Worth While?

To the members of the A. E. S.

Does your membership mean anything to you? Has it made you a more valuable man to your employer, and increased your knowledge of the art of electroplating? I am sure it has or you would not have kept your membership in our society during the past few years when every one of us had to scratch to make ends meet.

Then why not give your friends and assistant foreman the same breaks you have had ... give them an application blank ... explain the advantages of membership to them. They will be glad to join with us in promoting the art of electroplating and in turn increase the prestige of the A.E.S. so that in a short time we will not have to seek members. They will be only too glad to be a member of our society. If every member would get only one plater to join with us, think what that would mean by the time our next Convention rolls around. So let us start now and work hard and by the end of the year our society will show not less than a 50% increase in membership.

JOSEPH E. UNDERWOOD

Chairman of Membership Committee

Note - Status of Specifications for Electroplating on Steel

(For publication in *Metal Industry* and *Monthly Review*, American Electro-Platers' Society.)

The following statement has been prepared to meet inquiries regarding the status of the specifications for plating that were recently adopted by the American Society for Testing Materials and the American Electro-Platers' Society. Tentative specifications for plated coatings consisting of (a) nickel and/or chromium, (b) zinc and (c) cadmium on steel were prepared by a joint committee of the American Society for Testing Materials, American Electro-Plater's Society and the National Bureau of Standards. W. M. Phillips is chairman and W. Blum is secretary of that committee. These specifications were adopted by the A.S. T. M. and the A.E.S. in June, following their informal printing in the report of A. S. T. M. Committee A-5, and in the MONTHLY REVIEW of the American Electro-Platers' Society for May, 1935. They have not yet been released for formal publication. Just as soon as the exact form and wording are approved by the A.S.T.M. they will be released for general printing and distribution.

The Quality Standards Committee of the Master Electroplaters' Institute (of which M. M. Wise is chairman), was requested by the N.R.A. Code Authority for the Job Plating Industry to formulate standards for that industry. They decided to follow the specifications then under consideration by the A. S. T. M. and A. E. S. for plating on *steel*. In addition they found it necessary to prepare standards for plating on non-ferrous metals. As the research at the National Bureau of Standards on this subject has not been completed, tentative requirements were based on what is believed to be good practice in the plating industry. The latter specifications are therefore distinctly temporary and subject to revision in the light of researches now in progress or of further experience. These specifications for plating on non-ferrous metals have not been adopted by the A. S. T. M. or the A.E.S., but were adopted by the Master Electroplaters' Institute, whose entire specifications were published in the Metal Industry (New York) for July, 1935.

Pending the general distribution of the specifications for plating on steel in their final form, all persons connected with the plating industry are urged to become familiar with the main requirements as listed in the informal publications above referred to, so that as occasion arises they will be in a favorable position to apply these specifications in practice.

W. BLUM, *Secretary*,
Joint Committee on Specifications.

Membership Turnover

Thru September 18, 1935

ELECTED

Mr. Robert A. Stoll, 1530 East Hancock Ave., Detroit, Mich.
Associate, Detroit Branch

Mr. James L. Germaine, 5922 Commonwealth Ave., Detroit, Mich.
Active, Detroit Branch

John L. Nelson, 1717 North St., Philadelphia, Pa.
Active, Philadelphia Branch

APPLICATIONS

Paul Mentzer, 138 W. Godfrey Ave., Philadelphia, Pa.
Active, Philadelphia Branch

Harry Keller, 4742 Benner St., Philadelphia, Pa.
Active, Philadelphia Branch

Frederick Fulforth, Box 96, Roslyn, Pa.
Active, Philadelphia, Pa.

Mr. Chas. Anger, Udylite Corp., Cleveland, Ohio
Associate, Cleveland Branch

Mr. N. H. McKay, 1100 Pitts Street, Pittsburgh, Penna.
Active, Pittsburgh Branch

TRANSFERRED

R. Harr, Chicago Branch to Detroit Branch

SUSPENDED

F. Keller, 3836 Lawndale Ave., Chicago, Ill.

DEATH

John A. Storm, 1044 3rd St. Fullerton, Pa., member of Philadelphia Branch.

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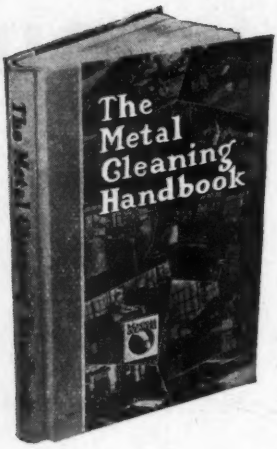


The Metal Cleaning Handbook

By

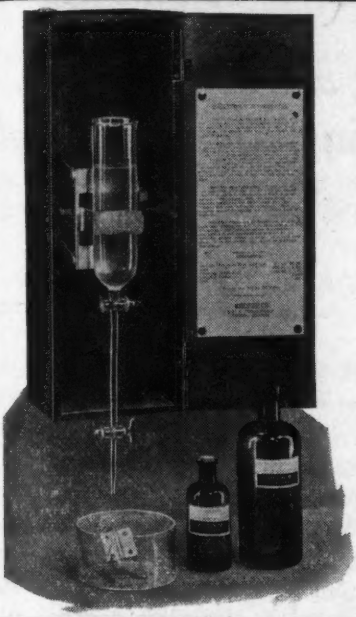
ROBERT W. MITCHELL, Ph. D.

The Magnus Chemical Company of Garwood, N. J. has just published a 220 page handbook on the cleaning of metals. The author, Dr. R. W. Mitchell, is well known in the plating industry. He has taken an active part in the activities of the A.E.S. and has read many most interesting papers at our conventions. The book is profusely illustrated and contains complete information on cleaning of every description. Each operation in cleaning from the setting up of tanks to the completed product, is dealt with in full detail. Burnishing, tumbling, tempering, agitation, mechanical washing, vapor and electrolytic cleaning, removing buffing compounds, removing various oils, paints, lacquer, etc., all are fully dealt with in this handsomely bound handbook.

Dr. Mitchell has gone far to bring to all interested in cleaning problems the most practical and up-to-the-date information obtainable.

The plater will welcome this handbook as there is a wealth of valuable data on subjects other than cleaning. The closing pages are devoted to plating solution formulae and a glossary of technical terms.

We hope one of these handbooks will be found in every plating room. A limited number of copies are available to those earnestly interested in metal cleaning. A copy to all others will be mailed for $1.00 which covers the cost of publication.



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Notes on **Polishing** *and* **Buffing** *Special Metals*

By R. S. LEATHER
The Lea Manufacturing Company, Waterbury, Conn.

THE following notes on polishing and buffing certain special metals have been adapted from the literature and from the experience of those in the industry. Little has been published on these metals as most articles dealing with polishing and buffing to any extent discuss only the common production metals and methods.

Cadmium is so soft that it is apt to be removed in the buffing and polishing process if the usual speeds and pressures are employed. According to W. L. Cassell[1] and A. B. Hoefer[1], it is best to get green men to do the buffing and teach them to use a very light pressure, since it has been found almost impossible to take a man familiar with buffing a hard surface such as stainless steel and put him on to cadmium plating buffing. Invariably he will polish off the coating and expose the base metal. It is possible, however, to give cadmium plated parts a bright lustre using the same general method as for buffing a soft metal such as copper.

F. Schwartz[2] also states that cadmium deposits are too soft for the ordinary polishing processes. He recommends a polishing agent composed mainly of French chalk with a binder of waxes and oils. Tripoli should not be contained in such a polish.

In buffing gold the main object is to remove the least metal possible, the action here being entirely a burnishing process. Canton flannel buffs and rouge are commonly employed.

A dull finish on pewter ware is obtained by the use of a tampico or wire scratch brush with fine pumice stone as the abrasive. In the general buffing of pewter, rouge is the common abrasive. A short method for producing a satin finish on drawn or spun pewter articles such as lamp bases is to use Lea Compound Grade "C" on 12 64/68 loose buff at 1800 r.p.m. On pewter articles where a bright Butler finish is required usually two steps are necessary,

[1] W. L. Cassell & A. B. Hoefer — "Cadmium Plating" — "Iron Age" Vol. 134, July 12, 1934, pp. 24.

[2] F. Schwartz — "Polishable Cadmium Deposits" — "Oberflaechentechnik", April 2, 1935, pp. 82.

one a sand buffing operation and then the use of Lea Compound Grade "MF" which contains a finer abrasive on a 5" Moose buff at 3,000 r. p. m.

High power is required to produce a high polish on platinum and this is done with a good stiff nail brush using gilders whiting with alcohol and afterwards it is polished with chamois leather and dry whiting. The alternative method is to sand buff with pumice stone and oil or with crocus composition followed by a final finishing operation on a canton flannel buff with gold rouge and alcohol.

In grinding lead, when the scratches are too deep to be removed by buffing with tripoli, a leather covered wood wheel with No. 160 emery is used and the article is finished on a grease wheel.

Lead-antimony metal as used for coffin hardware is finished readily by one manufacturer with Grade "C" Lea Compound on a pocket-sewed type buff at 4,000 ft. per minute. This gives a good surface for subsequent lacquering with bronze or silver metallic pigmented lacquers to the shade desired.

A bright lustre on Britannia metal is obtained by using a lime composition with kerosene oil as the lubricant on a cloth buff.

Sheet tin is finished on a muslin buff charged with mild cutting tripoli compound for cutting down followed by color buffing with white coloring composition. In many cases only the first step is necessary on sheet tin.

LEA INSTALLS PERMANENT DISPLAY AT METAL PRODUCTS EXHIBIT

Rockefeller Center, New York City

The Lea Manufacturing Co., Waterbury, Conn. has placed a permanent exhibit of its two modern, fast-working buffing and polishing compositions - LEA COMPOUND and LEAROK - at the Metal Products, Inc., Exhibition, Rockefeller Center, New York City. In addition, there will be a display of many typical articles on which finishing costs have been reduced by the LEA METHOD built around LEA COMPOUND or LEAROK. These articles will include many classes of metals, plastic materials, wood products, as well as novelties and jewelry with lacquered or enameled surfaces. Those interested in the polishing, buffing and finishing of articles will find this display instructive as well as interesting.

The BUYERS' GUIDE

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The Harshaw Chemical Co., Cleveland and large cities.
The Udylite Co., 1651 E. Grand Blvd., Detroit, Mich.

Ball Anodes

The Udylite Co., Detroit, Mich.

Buffs and Buffing Compositions

Chas. F. L'Hommedieu & Sons Co., 4521 Ogden Ave., Chicago, Ill.
Hanson-Van Winkle-Munning Co
Lea Mfg. Co., Waterbury, Conn
MacDermid Inc., Waterbury, Conn.
Matchless Metal Polish Co., Glen Ridge, N. J. and Chicago, Ill.
Frederic B. Stevens, Inc., Detroit Mich.
The Udylite Co., 1651 E. Grand Blvd., Detroit, Mich.

Burnishing Compounds

Magnus Chemical Co., Garwood, N. J.
Oakite Products Inc., New York City

Cadmium Service

Hanson-Van Winkle-Munning Co.
The Udylite Co., 1651 E. Grand Blvd. Detroit, Mich.

Cadux Materials

Hanson-Van Winkle-Munning Co., Matawan, N. J.

Chromium Service

United Chromium Inc., 51 E. 42nd St., New York, N. Y.
Hanson-Van Winkle-Munning Co.
Oakite Products Inc., New York City

Cleaners and Chemicals

Hanson-Van Winkle-Munning Co.
Lea Mfg. Co., Waterbury, Conn.
MacDermid Inc., Waterbury, Conn.
Oakite Products Inc., 52H Thames St., New York City
The Udylite Co., 1651 E. Grand Blvd., Detroit, Mich.
Magnus Chemical Co., Garwood, N. J.

Equipment

Crown Rheostat and Supply Co., 1910 Maypole Ave., Chicago, Ill.
Hanson-Van Winkle-Munning Co.
Chas. F. L'Hommedieu & Sons Co., 4521 Ogden Ave., Chicago, Ill.
Frederic B. Stevens Inc., Detroit, Mich.
The Udylite Co., Detroit, Mich.

Bright Nickel Solution

Pyrene Mfg. Co., Newark, N. J.

Metal Lacquers and Finishes

Maas & Waldstein Co., 432 Riverside Ave., Newark, N. J.
Zapon Company, Stamford, Conn

Metal Working Lubricants

Magnus Chemical Co., Garwood, N. J.

Oxidizing Agent

Sulphur Products Co., Greensburg, Pa.

Polishing Wheels and Materials

Hanson-Van Winkle-Munning Co.
Chas. F. L'Hommedieu & Sons Co., 4521 Ogden Ave., Chicago, Ill.
Matchless Metal Polish Co., Glen Ridge, N. J. and Chicago, Ill.
The Udylite Co., Detroit, Mich.

Polishing Lathes

Crown Rheostat & Supply Co., 1910 Maypole Ave., Chicago, Ill.
Hanson-Van Winkle-Munning Co.
Chas. F. L'Hommedieu & Sons Co., 4521 Ogden Ave., Chicago, Ill.

Soaps

Magnus Chemical Co., Garwood, N. J.

Solution Control Methods

Hanson-Van Winkle-Munning Co., Matawan, N. J.

Testing Instruments

Kocour Co., 4725 Turner Ave., Chicago, Ill.

Udylite Cadmium Service

MacDermid Inc., Waterbury, Conn.